(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
6 December 2001 (06.12.2001)

PCT

(10) International Publication Number
WO 01/92655 A1

(51) International Patent Classification[7]: E04B 1/24, F16S 3/04

(21) International Application Number: PCT/SE01/01207

(22) International Filing Date: 30 May 2001 (30.05.2001)

(25) Filing Language: Swedish

(26) Publication Language: English

(30) Priority Data:
0002025-5 30 May 2000 (30.05.2000) SE
0004761-3 20 December 2000 (20.12.2000) SE

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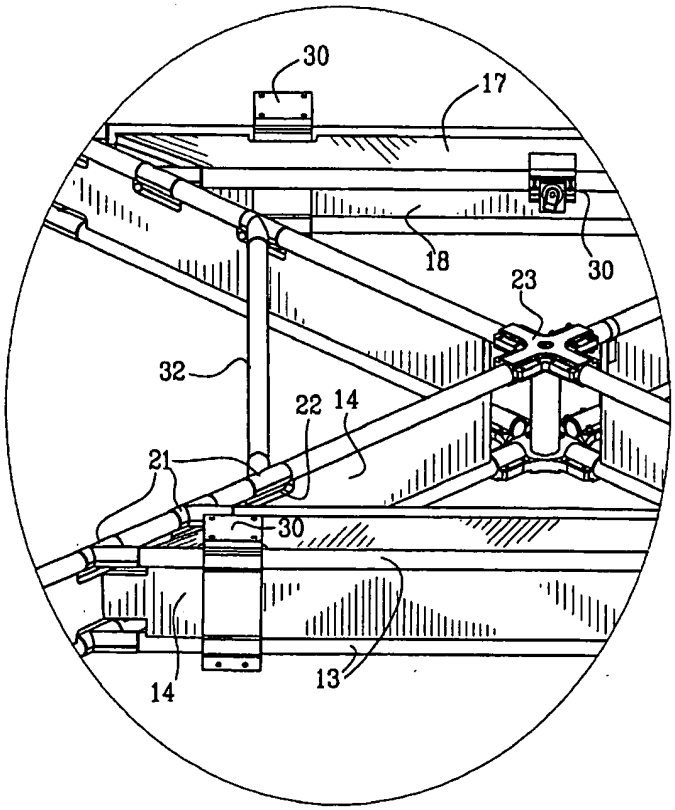
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EC, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian

[Continued on next page]

(54) Title: SUPPORT STRUCTURE



(57) Abstract: The invention relates to a framework construction having low weight, high rigidity and strength and of the kind comprising beams (11) in the form of tubes, which are interconnected by means of joints (21) to form a three-dimensional frame structure. The beams (11) in their basic shape consist of two tubes (13) connected to one another by means of a web (14), forming an I-beam (12). The beams (11), depending on load conditions and demands for rigidity, are assembled from several I-beams, forming L, U and/or box-profiles or combinations thereof. In order to form the frame structure, at least the tubes (13) of the beams are connected to each other through tube joints (21) at the ends of the beams and/or along the length of the beam in regions (22) designed therefore. The tube joints (21) are non-rotationally mounted to at least the tubes.

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patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

— *with international search report*

SUPPORT STRUCTURE

The present invention relates to a lightweight framework construction of high rigidity and strength, and of the kind comprising beams in the form of tubes, which are interconnected by means of joints to form a three-dimensional frame structure.

The background of the invention and the problem

Framework constructions are used in many contexts, and particularly where it is desirable to achieve low weight, while simultaneously maintaining high rigidity and strength. However, the weight of the material itself constitutes a limit, even if extremely lightweight materials, such as carbon fibre, are chosen.

Holders for work pieces to be handled by a robot, so called halters, are constructional details where weight is of crucial importance, since the robot has a limited ability to handle loads up to a certain weight limit. If the weight of the holder can be reduced, while maintaining, or even increasing, the strength and rigidity, this will benefit the work piece, by enabling the robot to handle bigger or heavier loads, and to position these with a higher degree of accuracy during the manufacturing process.

The purpose of the invention and the solution of the problem

The purpose of the invention is to provide a framework construction of the kind initially mentioned, that fulfils the demands stipulated regarding low weight, high strength, and high rigidity in the plane of the framework construction, as well as out of this plane. It should be further characterised by a simple structure, and by conveniently being able to be varied in size and shape, i.e., being able to be combined into several different structures.

These aims have been solved by the characteristics indicated in the appended claims.

Brief description of the drawings

In the following, the invention will be described, in the form of an embodiment, with reference to the accompanying drawings.

Fig. 1 shows in perspective a part of an I-beam included in the framework construction of the invention.

Figs. 2, 3, and 4 show in perspective structures that may be built from the beam shown in Fig. 1, i.e., an L-profile, a U-profile, and a box-profile.

Fig. 5 similarly shows in perspective one example of a holder, implemented in a frame structure, and a framework design, assembled by means of some of the beams of the invention.

Fig. 6 shows a part of the holder of Fig. 5 on a larger scale.

Fig. 7 shows in perspective an assembled tube joint.

Detailed description of a preferred embodiment

The framework construction according to the invention consists of a framework constructed from beam profiles 11, which may be I, L U, or box profiles, even though other combinations may be contemplated. In its simplest embodiment the beam is constituted by an I-profile 12, the "flanges" 13 of the profile consisting of tubes made, e.g., from carbon fibre, aluminium, titanium, or similar material of low weight, and the "web" 14 is constituted by a sandwich structure consisting, e.g., of a suitable core material, for instance, foamed PVC, and a covering material in the form of a laminate, e.g., carbon fibre. The flanges 13 are connected, in a load bearing manner, to the web 14 in an appropriate way, depending on the materials involved, e.g., through gluing, welding, in connection with extrusion of the profile, or similar.

The simple I-beam 12 may be assembled into several different structures, depending on the demands for rigidity and strength placed on the framework construction. Thus, the L-beam 15 is assembled from two I-beams with a common connection joint – tube 16 – between the two legs 17 and 18 of the "L". The U-profile 19 and the box profile 20 are constructed in the same way.

The beams 12, 15, 19 and 20 may be "tailored" and mounted on any framework for different applications. The beams are connected by means of tube joints 21 of the branch joint type, each individual tube in the different beams being interconnected to form a framework construction. In Fig. 5, a holder for an object is shown, which is to be positioned by a robot in a predetermined position for machining in an automated manufacturing process, or for assembling, e.g., to a chassis in the vehicle industry. The tube joints 21 may suitably be of two kinds, one kind which is threaded onto the tubes from the ends, and one type which is divided in order to be able to be mounted at any position along the length of any of the tubes. In the latter case, a recess 22 is arranged in the web 14 at the position where the tube joint 21 is to be placed. The tube joints are available at least in the most common angles, 15, 30, 45, and 90 degrees, and in the form of joint connections 23 for connecting several, for example four, crosslaid beams. The tube joints are non-rotationally connected to the respective tubes 13 by means of glue, welding or pinch joints or the like.

The embodiment according to Figs. 5 and 6 illustrates a framework construction in the shape of a frame structure forming a holder 24, also known as a halter, for a constructional component (not shown) to be machined or mounted on another constructional component. The holder 24 is designed with a central joint connection 23, which also forms an attachment point for a robot arm. The joint connection 23 connects four crosslaid I-beams 25, the outer end parts of which are interconnected with a rectangular frame structure consisting of I-beams 26 and 27, positioned opposite to one and other, and L-beams 28 and 29, arranged transverse in relation to the former. On the beams, attachments 30 are arranged, for retaining the constructional component in question. At the free ends of the beams 25, attachments 31 are arranged for the positioning of the holder in relation to fixed reference points. Between the beams, struts 32 for improved rigidity, in the form of simple tubes, may be arranged, on which further attachments may be positioned.

In the embodiment shown, the beams 26, 27 and 28, 29 of the frame structure are situated on different levels, but it is of course possible to design branch joints 21 for connection of more than two tubes, e.g., three or four, which may also have different

angles.

In some situations, it may be appropriate not only to connect the tubes 13 together but also the webs 41, in an intersection as shown in Fig. 6. The tube joints 21 may also be designed in such a way that both the tubes 13 and the web 14 can be pushed into them, so that an effective connection of the entire beam is achieved.

CLAIMS

1. A framework construction having low weight, high rigidity and strength and of the kind comprising beams (11) in the form of tubes, which are interconnected by means of joints (21) to form a three-dimensional frame structure,
characterised in that
the beams (11) in their basic shape consist of two tubes (13) connected to one another by means of a web (14), forming an I-beam (12),
said beams (11), depending on load conditions and demands for rigidity, being assembled from several I-beams, forming L, U and/or box-profiles or combinations thereof, and
for forming the frame structure, at least the tubes (13) of the beams are connected to each other through tube joints (21) at the ends of the beams and/or along the length of the beam in regions (22) designed therefor, and in that
the tube joints (21) are non-rotationally mounted to at least the tubes.

2. A framework construction according to claim 1,
characterised in that
the tubes (13) which form the flanges of the I-beams (12) are manufactured from a lightweight material, preferably carbon fibre,
the web (14) of the I-beam is constituted by a sandwich construction consisting of a core of, for example, foamed PVC with a covering layer, e.g., of carbon fibre, and that
the tubes (13) are connected to the web (14) by means of glue joint or similar.

3. A framework construction according to claims 1 or 2,
characterised in that
it is designed as a holder in the shape of a frame structure (26 – 29), which is substantially rectangular and connected at its corners to a crosslaid beam system (25), in the centre of which an attachment (23) is arranged for a handling unit, such as a robot, and that
at the beams (11) are arranged attachments (30) laterally and displaceable along the beams and fixable thereto for a machining or assembling detail, which attachments are

arranged to cooperate with the two tube-formed flanges (13) of the beam.

4. A framework construction according to claim 1,
characterised in that
the areas (22) arranged along the length of the beam for attachment of branched tube joints (21) are constituted by recesses in the web (14).

5. A framework construction according to claim 1,
characterised in that
the webs (14) of the beams are connected together at an intersection.

6. A framework construction according to claim 1,
characterised in that
the tube joint (21) is designed for connection of the tubes (13) and the web (14) between these.

7. A framework construction according to claim 1,
characterised in that
the beam (11) is constituted by a welded or extruded profile.

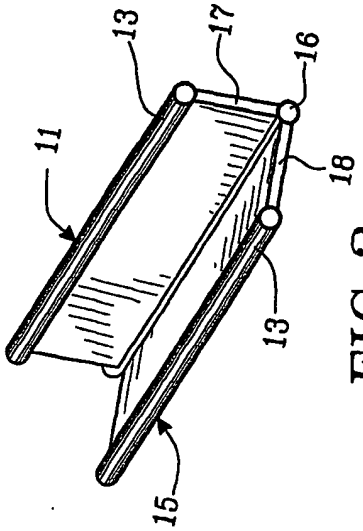

FIG.2

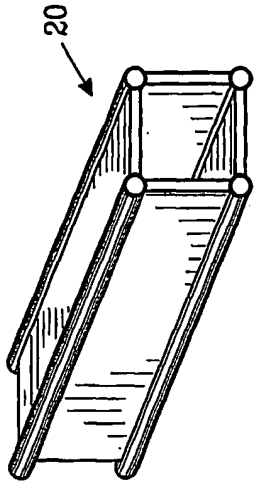

FIG.4

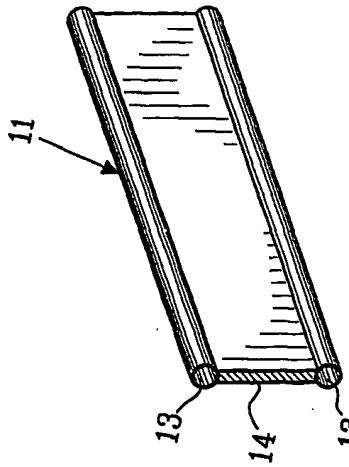

FIG.1

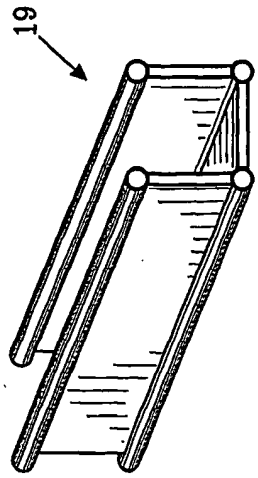

FIG.3

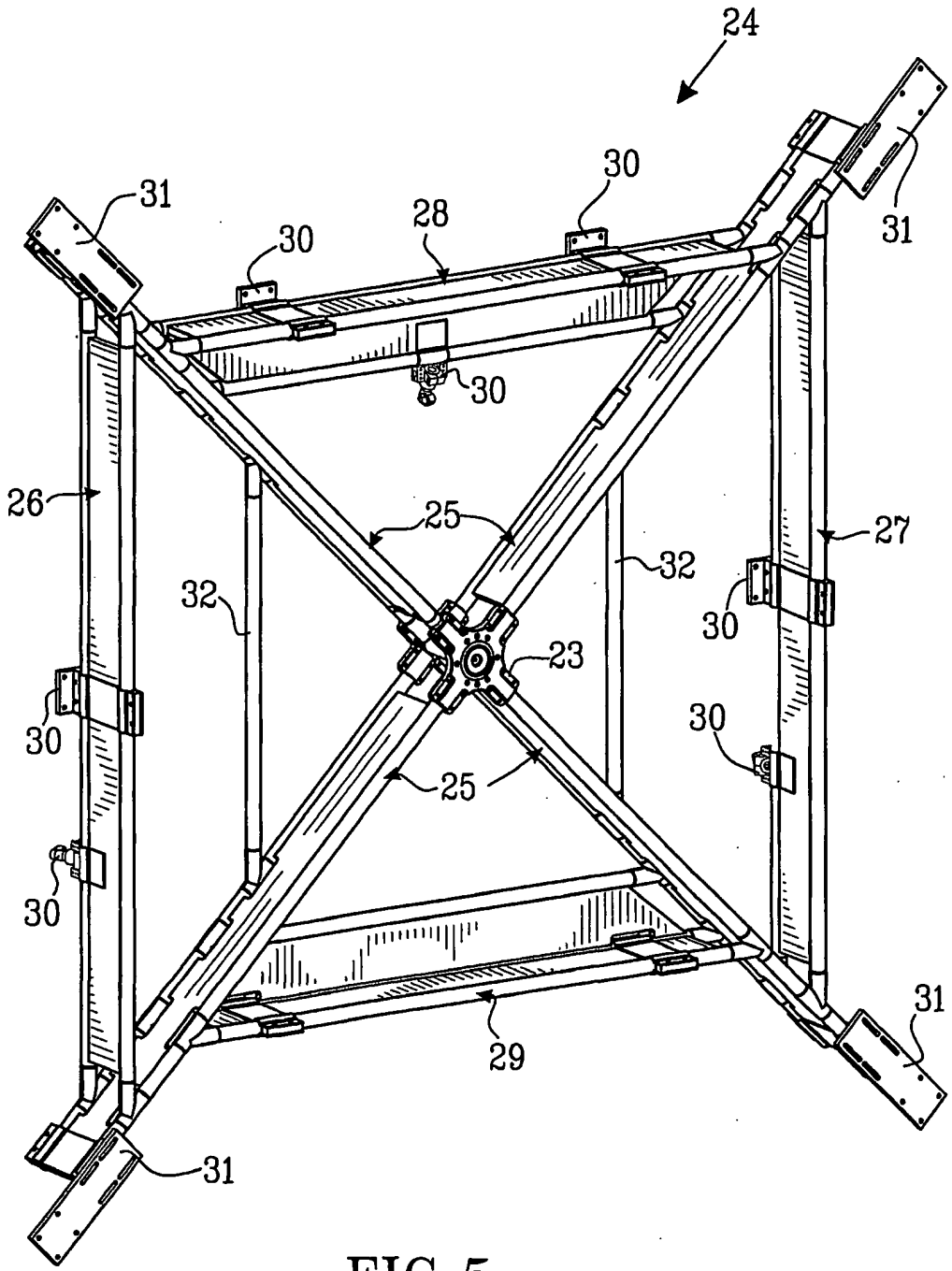

FIG.5

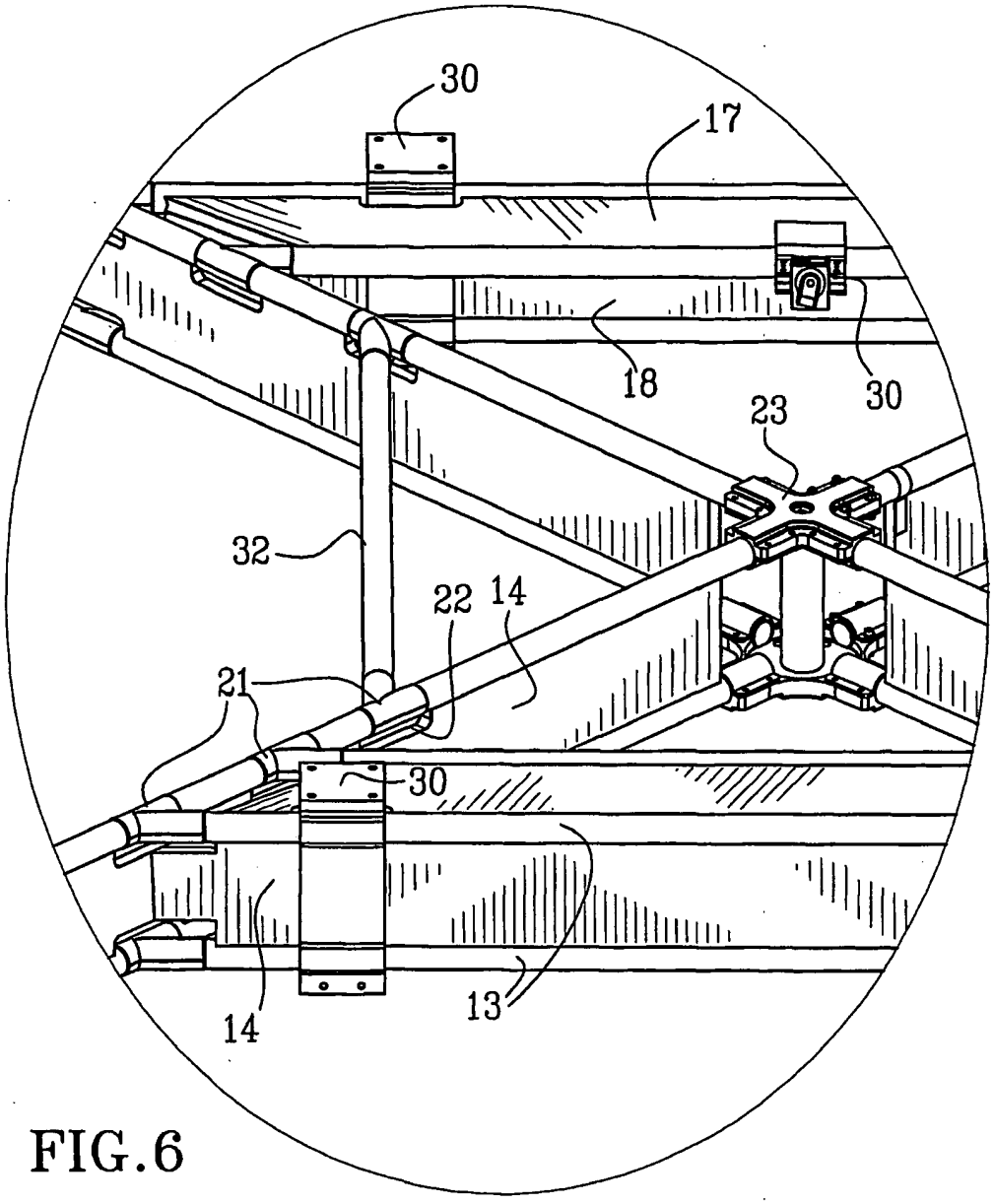

FIG.6

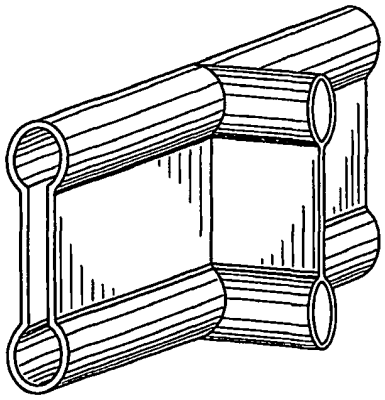

FIG.7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 01/01207

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: E04B 1/24, F16S 3/04
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: E04B, E04C, F16S

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	WO 8808940 A1 (SVENSSON, L. ET AL), 17 November 1988 (17.11.88), page 3, line 23 - page 4, line 3; page 4, line 29 - page 5, line 18, figures 1-9	1.7
X	DE 2526723 A1 (U. SCHÄRER SÖHNE AG (USM)), 23 December 1976 (23.12.76), page 3, line 16 - page 4, line 24, figures 1-5	1

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
31 July 2001	31 -07- 2001
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Ingemar Hedlund / MRo Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 01/01207

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	GB 1223016 A (ST. BERNARD PLASTICS LIMITED), 17 February 1971 (17.02.71), page 1, line 28 - line 56, figures 1-4 -- --------	1-7

INTERNATIONAL SEARCH REPORT

Information on patent family members

02/07/01

International application No.
PCT/SE 01/01207

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GB 1223016 A	17/02/71	NONE	